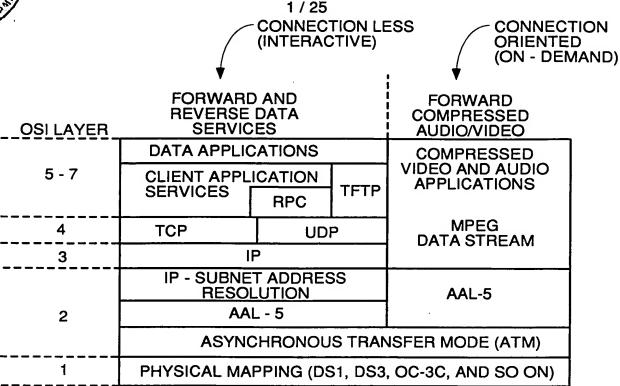
WING 5 TOWN THE

Application No.: 10/678,674 Inventor: RAKIB Docket No.: TER-041.1P Title: THIN DOCSIS IN-BAND MANAGEMENT FOR INTERACTIVE HFC SERVICE DELIVERY



PRIOR ART TIME WARNER FULL SERVICE NETWORK PROTOCOL STACK

FIG. 1

PEGASUS CHANNEL TYPES

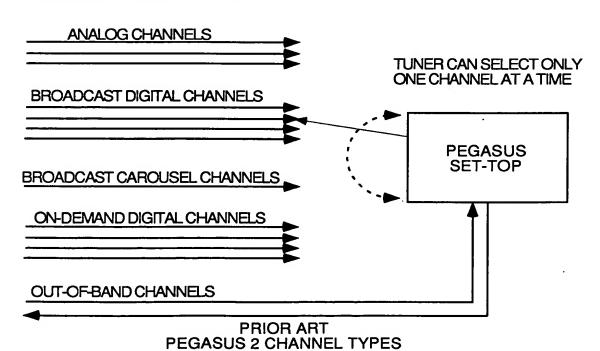
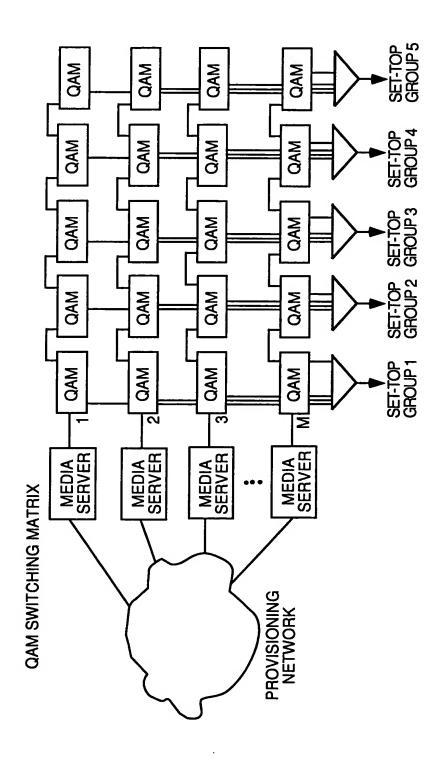


FIG. 2

2/25



PRIOR ART
PEGASUS 2 QAM SWITCHING MATRIX
TO IMPLEMENT MPEG-2 TRANSPORT SWITCH

3 / 25

COMMUNICATIONS STACK

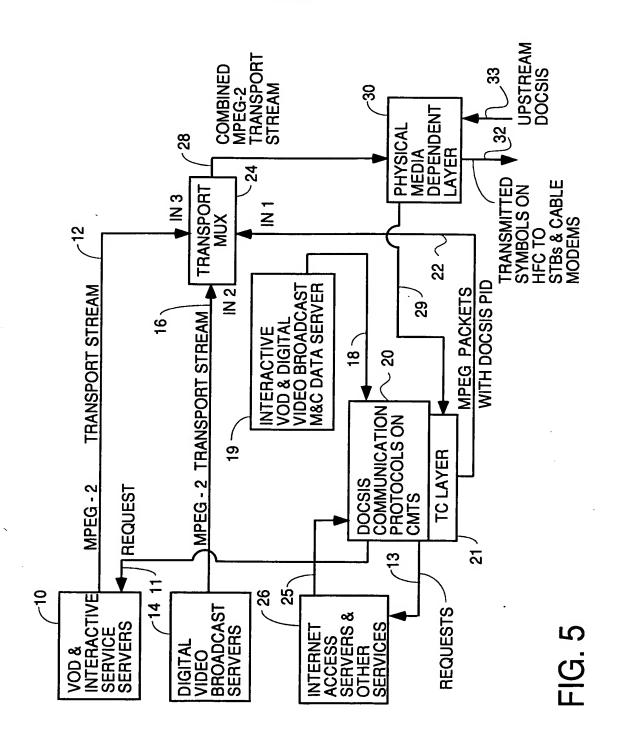
TCP		UDP				
INTERNET PROTOCOL (IP))	MPEG AUDIO	MPEG VIDEO	
ATM ADAPTATION LAYER 5 (AAL-5)						
ASYNCHRONOUS TRANSFER MODE (ATM)						NTSC 6-Mhz CHANNELS
PHYSICAL LAYE CONVERGENCE PROCEDURE	=	TIME DIVISION		SA MULTI-RATE TRANSPORT		
DS1 EXTENDED SUPER FRAME		MULTIPLE ACCESS		(SA-MRT)		·
QUADRATURE PHASE SHIFT KEYING (QPSK)				QUADRATURE AMPLITUDE MODULATION (QAM-64)		
FREQUENCY DIVISION MULTIPLEXING						

PRIOR ART

FSN COMMUNICATION PROTOCAL STACK MPEG DELIVERED OVER ATM SWITCHED NETWORK

FIG. 4

4/25



5/25

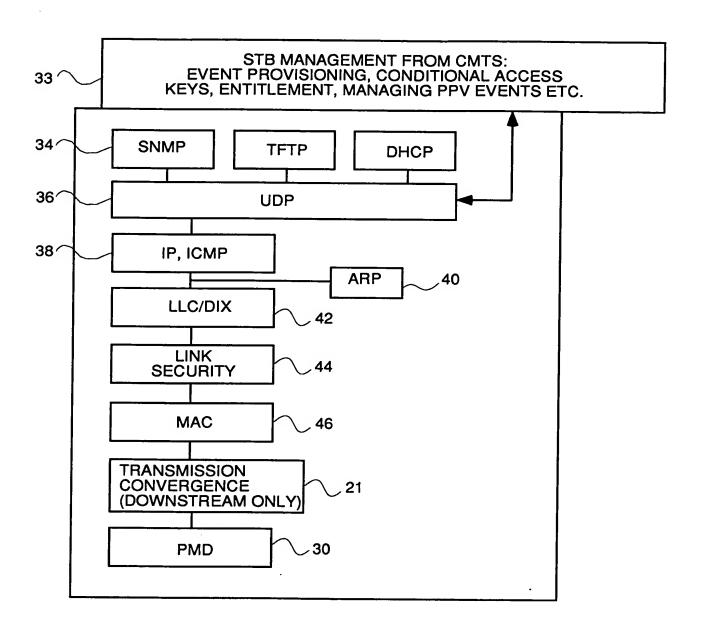
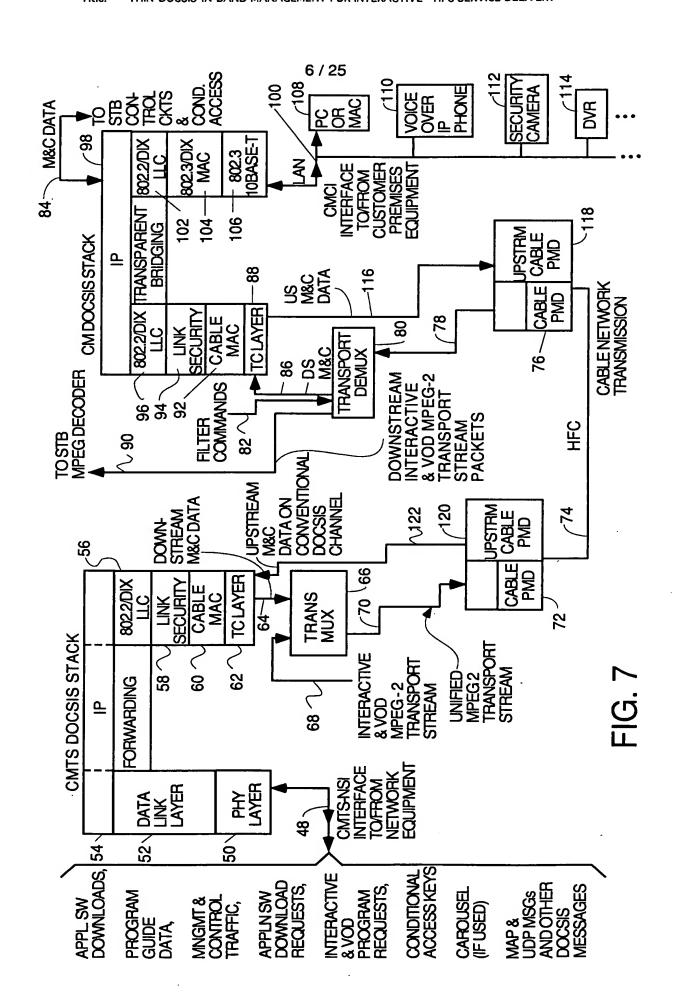
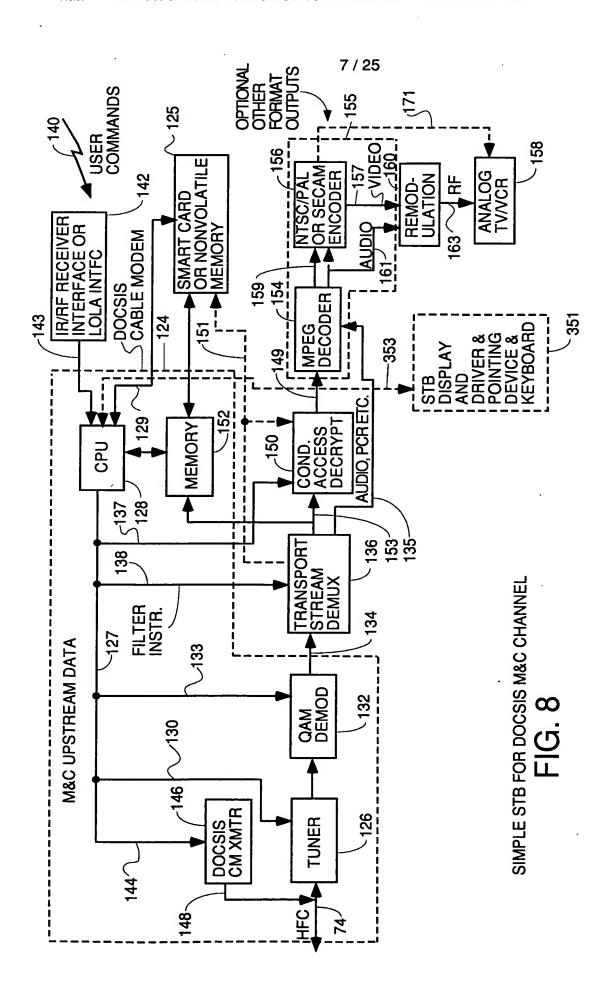
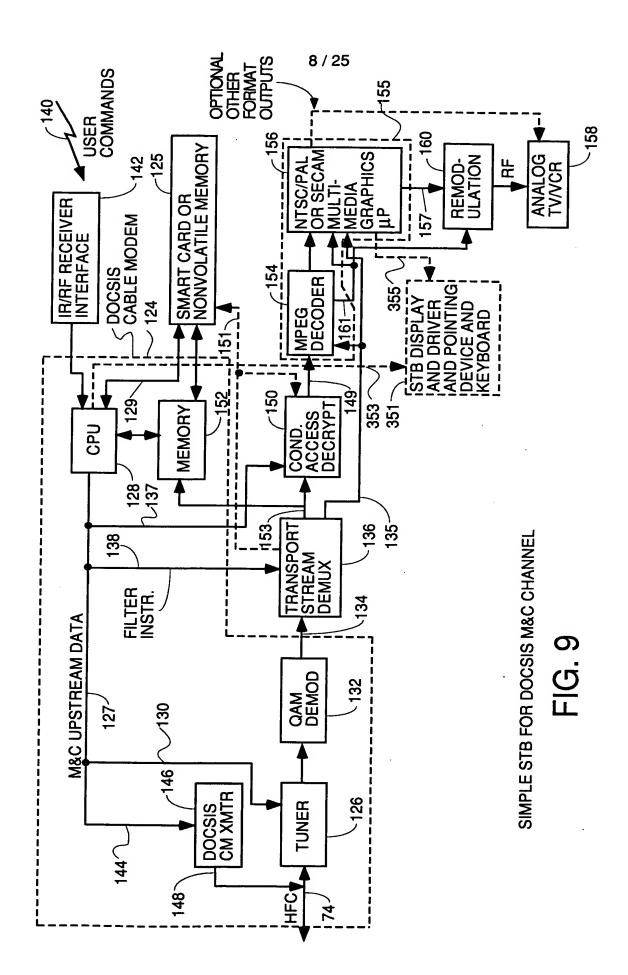
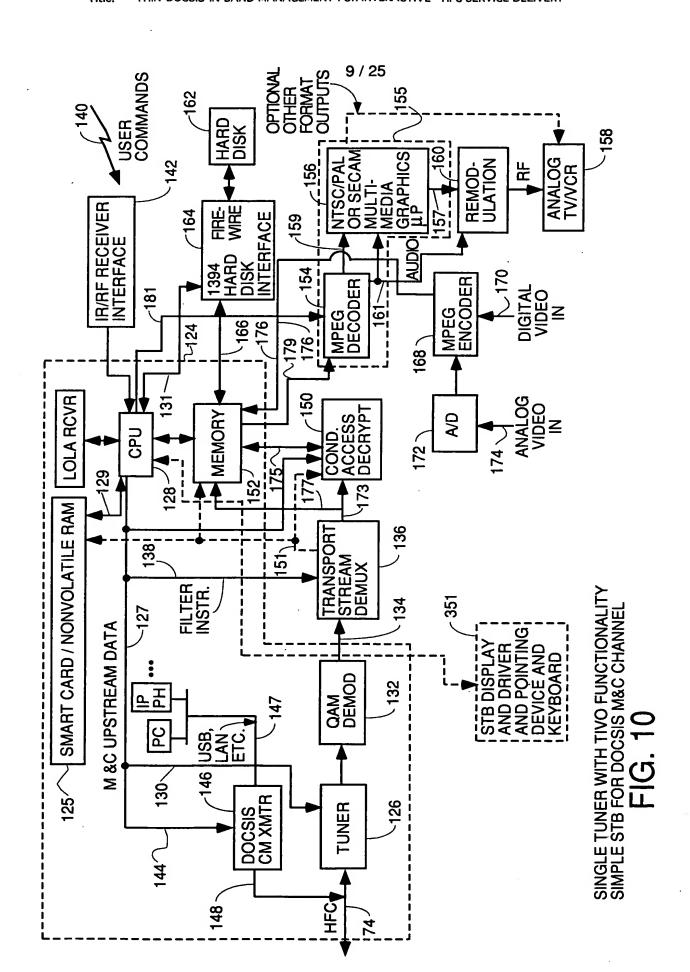


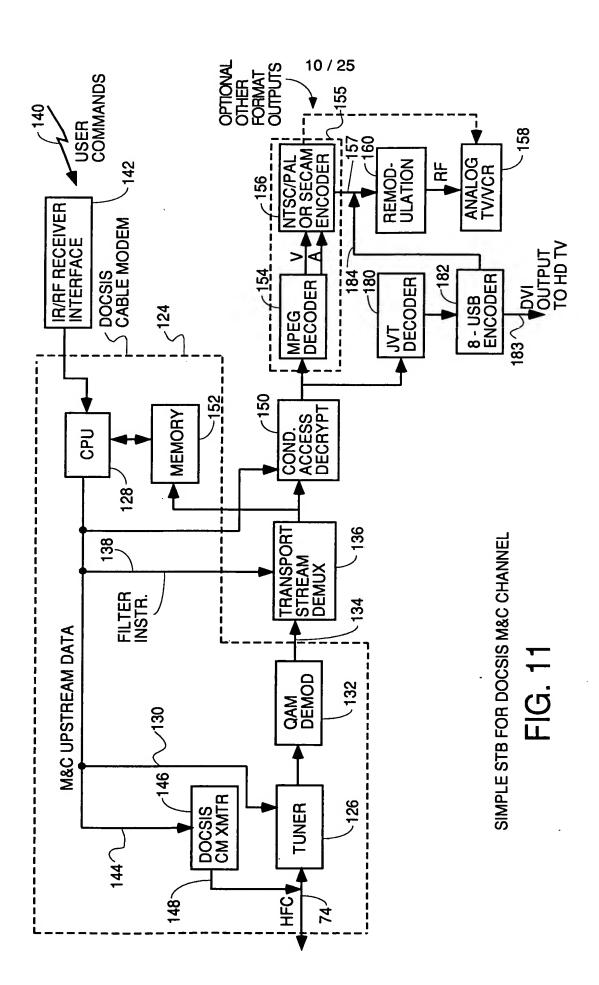
FIG. 6











11/25 -214 EMM 3 212 204 PCR 3 220 202 210 BCM 9 192 EMM 2 PID M 194 **EMM-3 REFERENCE EMM-1 REFERENCE EMM-2 REFERENCE** EMM PMT SECTIONS PROG 3 206 VIDEO 216 급-198 CA SYSTEM 2 CA SYSTEM CA SYSTEM 3 208 AUDIO 3 문도 196 218 204 VIDEO PID M PID 0 PAT SECTIONS ALTERNATIVE EMBODIMENT: ELIMINATE CAT TABLE AND PROG 3 SEND TARGET 190

12 / 25

PROCESS FOR PROVIDING MANAGEMENT AND CONTROL DATA IN-BAND ON AN MPEG MULTIPLEX ON THE DOCSIS PID

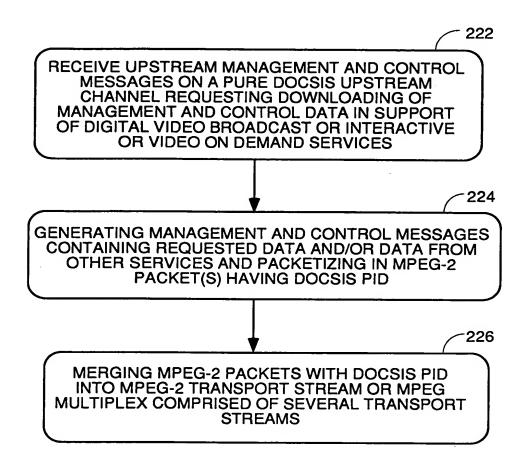


FIG. 13

13 / 25

PROCESS FOR PROVIDING TARGETED CONDITIONAL ACCESS DATA IN-BAND ON AN MPEG MULTIPLEX WITHOUT USING A DATA CAROUSEL

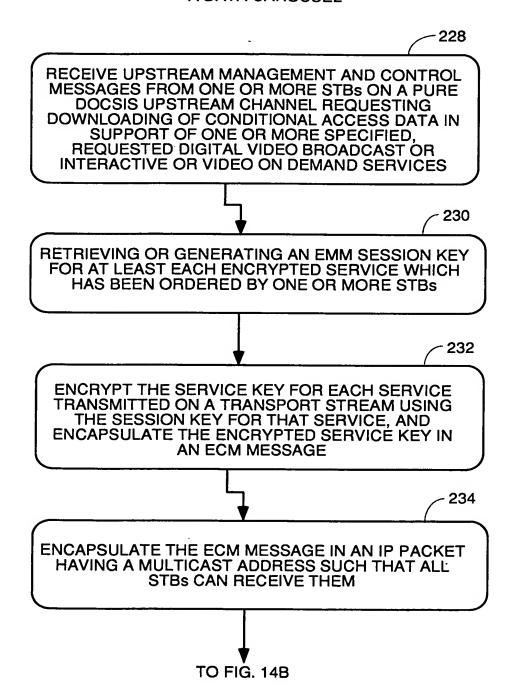


FIG. 14A

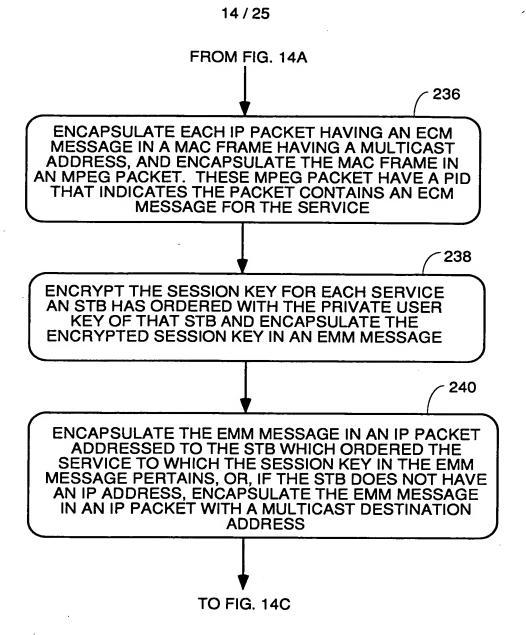


FIG. 14B

15 / 25

FROM FIG. 14B

ENCAPSULATE EACH IP PACKET CONTAINING AN EMM MESSAGE FOR A PARTICULAR REQUESTED SERVICE INTO A MAC FRAME ADDRESSED TO THE STB WHICH REQUESTED THE SERVICE, AND ENCAPSULATE THE MAC FRAME IN AN MPEG PACKET HAVING THE DOCSIS PID ALONG WITH OTHER MPEG PACKETS HAVING THE DOCSIS PID AND CONTAINING OTHER M&C DATA. IN ALTERNATIVE EMBODIMENTS, ENCAPSULATE THE IP PACKET IN AN MPEG PACKET HAVING A PID WHICH INDICATES IT IS AN EMM MESSAGE FOR A PARTICULAR SERVICE AND ENTER THAT PID IN THE CAT TABLE FOR THE TRANSPORT STREAM ON WHICH THE EMM MESSAGE IS TRANSMITTED

244

-242

ADD THE MPEG PACKETS THAT BEAR THE EMM AND ECM MESSAGES FOR EACH SERVICE IN THE MPEG TRANSPORT STREAM WHICH CONTAINS THE MPEG PACKETS BEARING ENCRYPTED DATA OF SAID SERVICE AND MERGE OTHER MPEG PACKETS HAVING THE DOCSIS PID AND CONTAINING OTHER M&C DATA INTO THE ONE OR MORE TRANSPORT STREAMS OF THE MPEG MULTIPLEX

246

ADJUST DATA IN PAT AND PMT TABLES OF SAID MPEG TRANSPORT STREAM OR MUTIPLEX TO REFLECT THE PIDS OF SAID PACKETS CONTAINING THE ENCRYPTED AUDIO, VIDEO OR OTHER PAYLOAD DATA OF THE SERVICE, THE PCR TIMING DATA, AND THE ECM PACKET FOR THE SERVICE. ADJUST THE CONDITIONAL ACCESS TABLE TO INCLUDE DATA TO POINT TO THE EMM MESSAGE FOR EACH SERVICE IF THE DOCSIS PID IS NOT USED TO SEND THE EMM MESSAGES.

16 / 25

PROCESS CARRIED OUT IN STB TO RECOVER EMM AND ECM MESSAGES FROM AN IN-BAND CHANNEL AND DECRYPT PAYLOAD DATA OF REQUESTED SERVICE

MICROPROCESSOR RECEIVES COMMANDS TO ORDER AN INTERACTIVE OR OTHER SERVICE OR TUNE A DIGITAL VIDEO BROADCAST, AND GENERATES AND SENDS UPSTREAM DOCSIS M&C MESSAGE REQUESTING APPROPRIATE APPLICATION SOFTWARE, PROGRAM GUIDE DATA, CONDITIONAL ACCESS DATA, ETC. (IF ANY) FOR REQUESTED SERVICE

_250

MICROPROCESSOR GENERATES FILTER COMMANDS TO CAUSE PID 0 PACKETS TO BE EXTRACTED FROM DOWNSTREAM MPEG TRANSPORT STREAM MULTIPLEX AND SENT TO IT FOR RE-CONSTRUCTION OF THE PROGRAM ALLOCATION (PAT) TABLE OF THE MPEG MULTIPLEX, AND RE-CONSTRUCTS THE PAT TABLE FROM THE EXTRACTED PACKETS

-252

MICROPROCESSOR USES PAT TABLE TO DETERMINE WHICH TRANSPORT STREAMS ARE IN THE MPEG MULTIPLEX AND WHICH TRANSPORT STREAM CONTAINS THE MPEG PACKETS OF THE DESIRED SERVICE, AND DETERMINES THE PID OF THE MPEG PACKETS THAT CONTAIN THE PROGRAM MAP TABLE (PMT) OF THE TRANSPORT STREAM CONTAINING THE REQUESTED SERVICE

· 254

MICROPROCESSOR GENERATES FILTER COMMANDS TO EXTRACT MPEG PACKETS CONTAINING THE PMT TABLE DATA AND RECONSTRUCTS PMT TABLE FROM THOSE PACKETS

256

MICROPROCESSOR SEARCHES PMT TABLE FOR ENTRY FOR REQUESTED SERVICE AND DETERMINES PID NUMBERS FOR THE VIDEO, AUDIO, SUPPLEMENTARY DATA, PCR AND ECM MESSAGES OF THE REQUESTED SERVICE AND GENERATES FILTER COMMANDS TO EXTRACT PACKETS WITH THOSE PIDS.

TO FIG. 15B

FIG. 15A

17 / 25 FROM FIG. 15A

258

PROGRAM DATA RECOVERY AND ROUTING:
EXTRACTED MPEG PACKETS CONTAINING
ENCRYPTED VIDEO, AUDIO, SUPPLEMENTAL DATA, PCR
DATA AND ECM MESSAGE DATA ARE RECOVERED ECM
MESSAGE DATA ARE RECOVERED AND ROUTED TO
APPROPRIATE CIRCUITS IN STB OR CONNECTED TO
STB BY BUS OR LAN FOR FURTHER PROCESSING

260

EMM MESSAGE RECOVERY:

IN EMBODIMENTS WHERE THE EMM MESSAGE IS SENT ON THE DOCSIS PID, THE MICROPROCESSOR GENERATES FILTER COMMANDS TO EXTRACT MPEG PACKETS HAVING DOCSIS PID AND RECOVERS MAC FRAMES OF DOCSIS PID PACKETS CARRYING THE EMM MESSAGE AND REJECTS ALL MAC FRAMES NOT ADDRESSED TO THIS STB.

IN EMBODIMENTS WHERE A CAT TABLE IS USED, PID 1
PACKETS ARE EXTRACTED AND THE MAC FRAMES THEREIN
ARE RECOVERED, AND THESE MAC FRAMES ARE ROUTED
TO A CAT TABLE RE-CONSTRUCTION PROCESS. THE
MICROPROCESSOR RECONSTRUCTS THE CAT TABLE, FINDS
EMM PID, GENERATES FILTER COMMANDS FOR THIS PID AND
EXTRACTS THE MPEG PACKETS CONTAINING THE EMM
MESSAGE FOR THE REQUESTED SERVICE FROM MULTIPLEX.
THE MAC FRAMES IN THE EXTRACTED PACKETS CONTAINING
THE EMM MESSAGE FOR THE REQUESTED SERVICE ARE
RECOVERED

262

RECOVER IP PACKETS CONTAINING EMM AND ROUTE: MICROPROCESSOR RECOVERS IP PACKETS FROM MAC FRAMES RECOVERED IN STEP 260 BEARING EMM MESSAGE(S) AND ROUTES IT/THEM TO THE EMM MESSAGE DECRYPTION PROCESS.

MPEG PACKETS WITH THE DOCSIS PID CARRYING OTHER M&C DATA ARE RECOVERED, THE MAC FRAMES AND ENCAPSULATED IP FRAMES ARE RECOVERED AND THE M&C DATA IS ROUTED TO THE APPROPRIATE CIRCUITRY IN THE STB OR CONNECTED TO THE STB BY BUS OR LAN CONNECTION FOR FURTHER PROCESSING

FIG. 15B

TO FIG. 15C

18 / 25

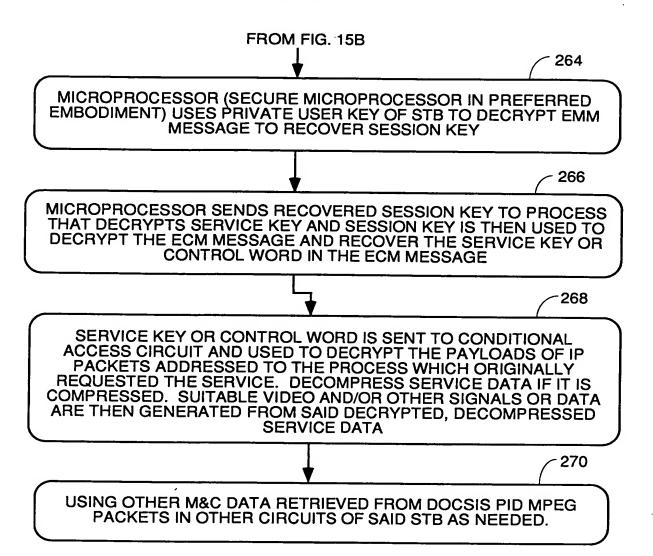


FIG. 15C

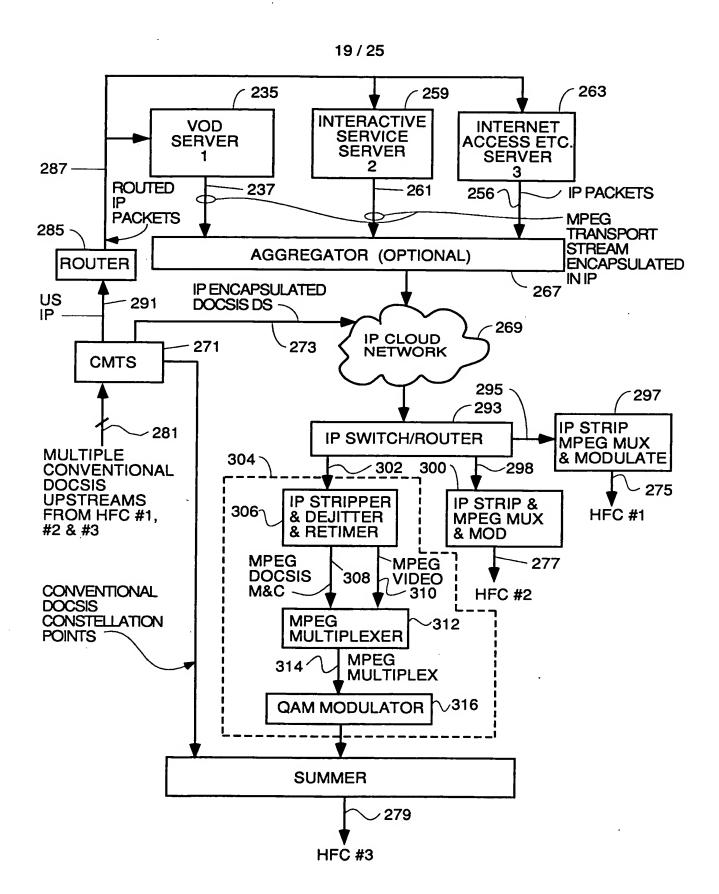


FIG. 16

20 / 25
PROCESS CARRIED OUT BY SIMPLE, SINGLE TUNER STB TO RECEIVE ENCRYPTED DIGITAL VIDEO BROADCASTS

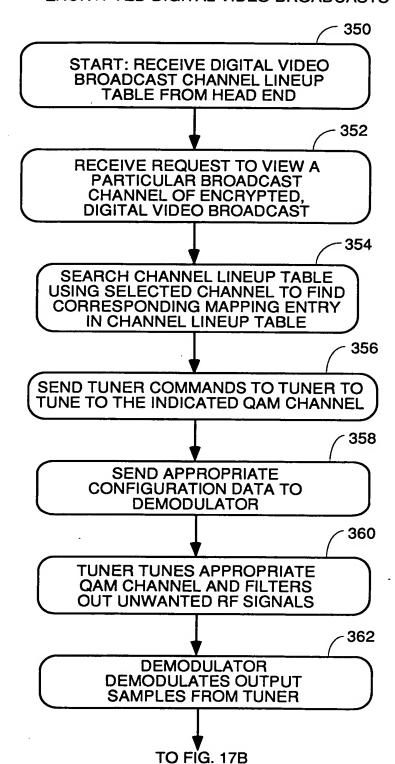


FIG. 17A

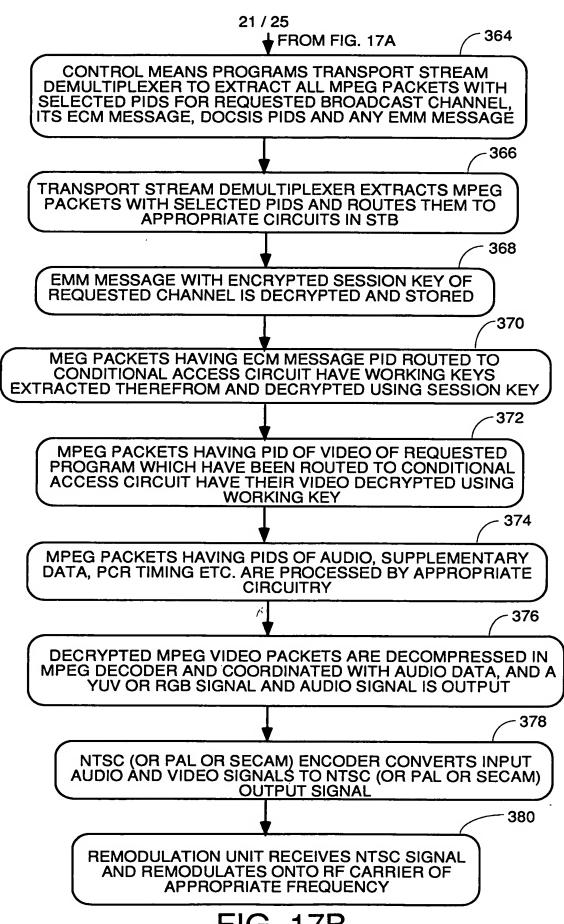
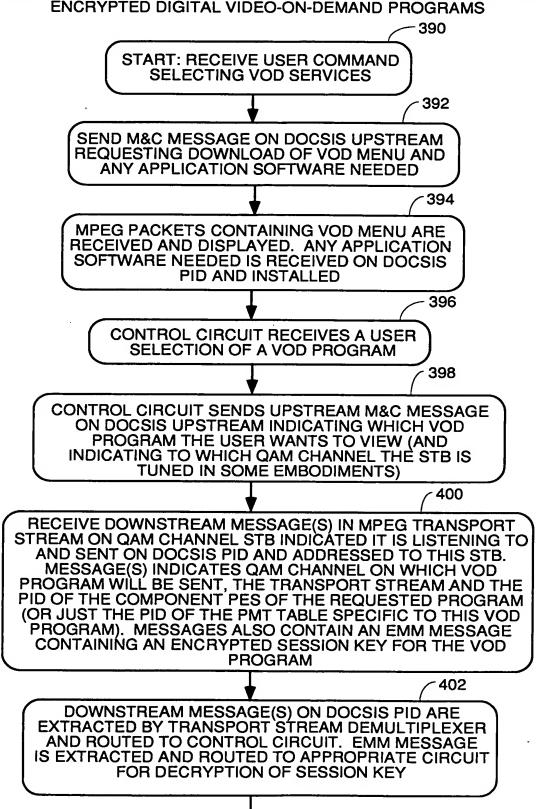


FIG. 17B

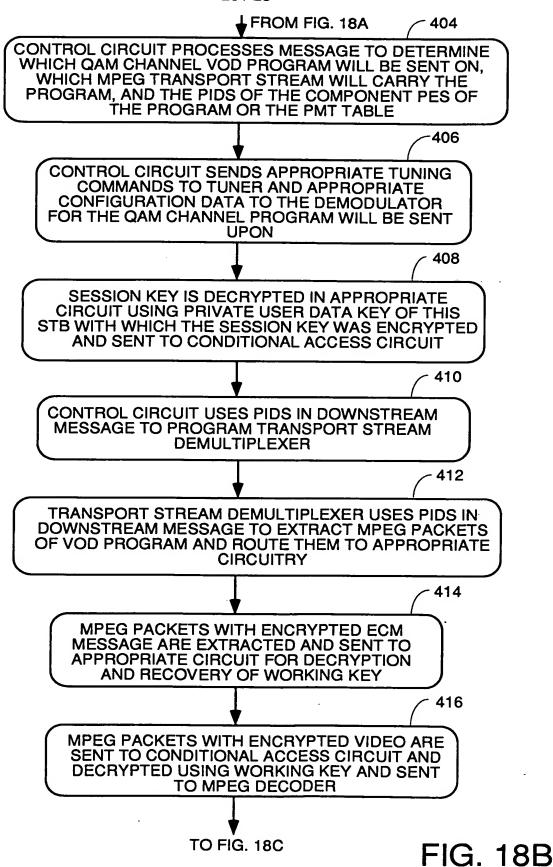
22 / 25

PROCESS CARRIED OUT BY SIMPLE, SINGLE TUNER STB TO RECEIVE ENCRYPTED DIGITAL VIDEO-ON-DEMAND PROGRAMS



TO FIG. 18B

23 / 25



24 / 25

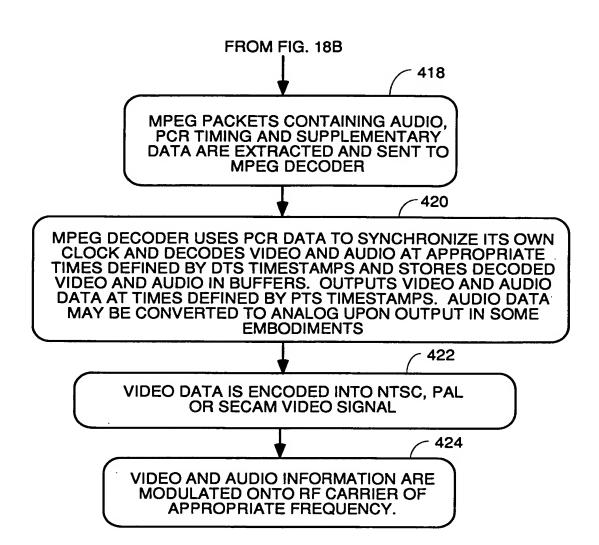


FIG. 18C

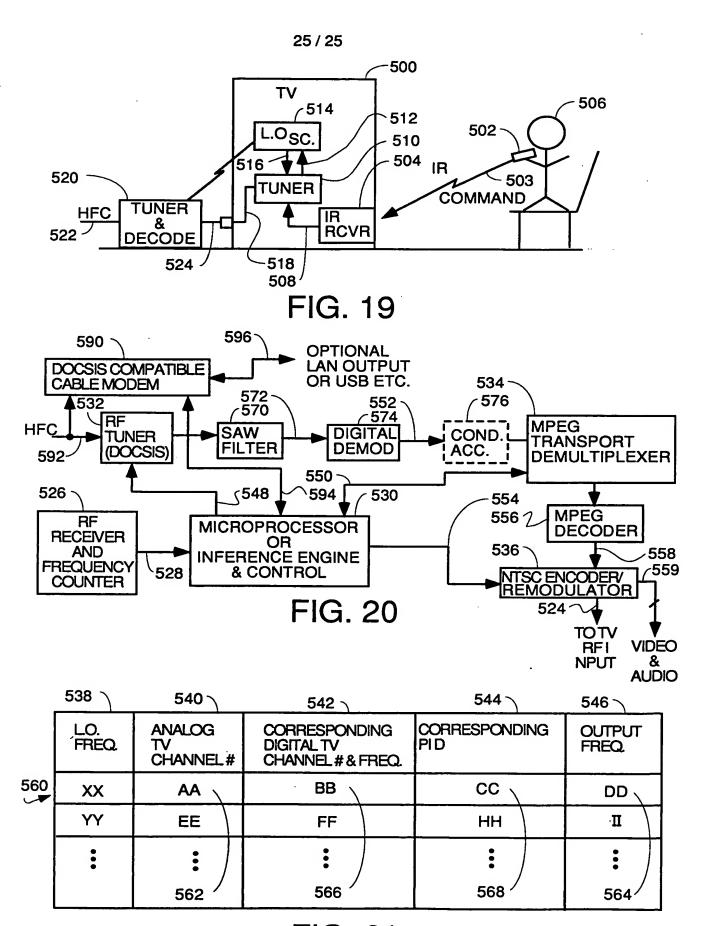


FIG. 21